DOCUMENT RESUME

ED 409 202 SE 060 414

AUTHOR Farley, Tom C.
TITLE Idaho K-8 Mathematics Course of Study Guide: A Guide for Excellence in Mathematics Education. Update.
INSTITUTION Idaho State Dept. of Education, Boise.
PUB DATE May 94
NOTE 69p.
PUB TYPE Guides - Classroom - Teacher (052)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Algebra; Elementary Education; *Elementary School Mathematics; *Mathematics Education; State Curriculum Guides
IDENTIFIERS Idaho

ABSTRACT

This course of study guide is designed to help teachers establish a continuity within the scope and sequence of their elementary school mathematics curriculum and to assist those teachers in formulating some realistic goals for themselves and their students. This guide delineates content requirements needed to satisfy K-8 proficiency expectations in mathematics. Part I contains an introduction, statement of philosophy, and a vocabulary position statement. Part II contains course outlines for kindergarten to eighth grade including outlines for Pre-Algebra and Algebra I. Part III contains a scope and sequence chart and two appendices--a partial vocabulary list and a resources list. (JRH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

3E

ED 409 202

IDAHO K-8 MATHEMATICS COURSE OF STUDY GUIDE

A Guide for Excellence in Mathematics Education

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
J. L. Evans
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

Tom C. Farley
Mathematics Coordinator

BEST COPY AVAILABLE

SE010414

TABLE OF CONTENTS

	Page
State Board of Education	i
Foreword	ii
Preface	iii
Acknowledgements	iv, v, vi
PART I	
Introduction and Statement of Philosophy	1
Vocabulary Position Statement	6
PART II	
Kindergarten	7
First Grade	10
Second Grade	14
Third Grade	18
Fourth Grade	22
Fifth Grade	27
Sixth Grade	33
Seventh-Eighth Grade	39
Pre-Algebra	46
Algebra I	51
PART III	
Scope and Sequence	56
Appendix A (Vocabulary)	57
Appendix B (Resource List)	59

STATE OF IDAHO

DEPARTMENT OF EDUCATION

IDAHO K-8 MATHEMATICS COURSE OF STUDY GUIDE

Written June 1987
Updated April 1990
Updated May 1994

Jerry Evans
State Superintendent

Darrell Loosle
Associate State Superintendent

Jerry Pelton
Bureau of Instruction

Tom C. Farley
Mathematics Coordinator

STATE BOARD MEMBERS

Roy E. Mosman
Curtis Eaton
Judy Meyer
Karl Shurtliff
Joe Parkinson
Carole McWilliam
Keith S. Hinkley

FOREWORD

A 12-member curriculum committee was assembled to write Idaho's K-8 Mathematics Course of Study Guide. The committee was composed of educators involved in classroom teaching from the kindergarten through 12th grade level. Administrators and college level personnel, under the guidance of the State Department of Education, worked together with the classroom teachers to design and write the K-8 guide. Resources from various progressive states, as well as input from our local school districts, were used in writing Idaho's guide.

This Course of Study Guide has been designed to help teachers establish a continuity within the scope and sequence of their elementary school mathematics curriculum and to assist in formulating some realistic goals for themselves and their students. It is not our purpose to outline methods and procedures nor to recommend activities, projects, units, or plans for students and teachers to do. These are adequately treated in the teachers' manuals of the State adopted textbooks and by local district-developed curriculum guides.

It is recommended that all Idaho public school districts utilize the State Elementary Course of Study Guide as a basic resource. It is the responsibility of the local boards, parents, administrators, and building supervisors to ensure that their program of instruction follows, at the minimum, the State guide.

I commend each person who participated in the writing of this guide. If used as a basic resource for the development of local guides, it should serve the public schools well and ensure quality instruction for Idaho students.

_____

State Superintendent of Public Instruction

PREFACE

The purpose of this course of study guide is to delineate content requirements needed to satisfy K-8 proficiency expectations in mathematics. The State Department of Education, in concert with the Elementary Mathematics Curriculum Committee, has defined and set forth this course of study for grades K-8. It now becomes the responsibility of the local school district to produce an instructional guide based upon the defined course of study.

Although educators sometimes use the terms interchangeably, a course of study is not an instructional or curriculum guide. To compare the two as used in this document, the following may be helpful:

COURSE OF STUDY	INSTRUCTIONAL GUIDE
1. Prescribes what is to be taught in a given subject or program.	1. Describes how the given subject or program may may be taught.
2. Defines the subject or program in terms of purpose, definition, student goals, and objectives.	2. Makes suggestions as to instructional aides, materials, learning experiences, and methods of teaching.
3. Can be changed only by action of the State Board of Education.	3. Is revised, adapted, changed as needed at the discretion of school educators.

Courses of study will generally be brief outlines in skeletal form. Instructional guides should be developed to augment and supplement courses of study.

The State Department of Education encourages administrators to **place this course of study with educators who teach mathematics in grades K-8.**

In order to fully utilize this course of study, it is essential for each district to provide continued instructional inservice. The State Department of Education has resources and personnel available for this purpose.*

*See Appendix B

ACKNOWLEDGEMENTS

Materials

Grateful acknowledgement is made to the following for permission to use their material in the Idaho K-8 Course of Study Guide.

State Department of Education, Olympia, Washington
Material taken from
Guidelines for K-8 Mathematics Curriculum

State Department of Education, Sacramento, California
Material taken from
Mathematics - Model Curriculum Guide K-8

State Department of Education, Salem, Oregon
Material taken from
Math in Oregon Schools

State Department of Education, Montpelier, Vermont
Material taken from
A Framework for Mathematics Curriculum Development in Vermont

State Department of Education, Lansing, Michigan
Material taken from
Minimal Performance Objectives for Mathematics Education in Michigan

State Department of Education, Montgomery, Alabama
Material taken from
Alabama Course of Study: Mathematics K-12

References

Hirsch, Christian R. and Zweng, Marilyn I.
The Secondary School Mathematics Curriculum
1985 Yearbook, NCTM

Shufelt, Gwen and Smart, James R.
The Agenda in Action
1983 Yearbook, NCTM

Rosskopf, Myron F., Steffe, Leslie P. and Taback, Stanley
Piagetian Cognitive/Development Research and Mathematical Education
1970, NCTM

Problem Solving in Mathematics
Lane E.S.D. Project, Dale Seymour Publications
Polya, George
How to Solve It
Doubleday & Co., Inc., Garden City, N.Y. 1957

Polya, George
Mathematical Discovery, Volume I
John Wiley & Sons, Inc., 1965

Wheatley, Grayson
Problem Solving Makes Math Scores Soar

ACKNOWLEDGEMENTS -- Continued

Grateful appreciation is extended to the following people for their dedication and professional expertise in writing this guide. Without their expertise and desire to improve the quality of mathematics education in Idaho, the project could not have been completed.

Karen Ritchie
Department of Teacher Education
Instructor
Elementary Math Methods
Boise State University
Boise, Idaho

James Irwin
Mathematics Teacher
Middle School
Kellogg, Idaho

Darrell Scott
Mathematics Teacher
16 years experience in 2nd-12th Grade Mathematics Instruction
High School
Lapwai, Idaho

Leona Dean
I. B. Perrine Elementary School
Fifth Grade
Twin Falls, Idaho

Gwendolyn J. Hanny
Harwood Elementary
Sixth Grade
Rigby, Idaho

Sharon Massey
Mtn. Home AFB Intermediate
Sixth Grade
Mtn. Home, Idaho

Clare M. Cook
English Teacher
Problem Solving/Basic Skills Participant
Jerome High School
Jerome, Idaho

Marlene Triplett
Orofino Elementary
1987 ICTM Elementary Teacher of the Year
Fifth Grade
Orofino, Idaho

Lorraine Blackham
Tendoy School
Kindergarten Teacher
District Kindergarten Coordinator
Pocatello School District
Pocatello, Idaho

Betty White
West Elementary
Vallivue District
Sixth Grade
Caldwell, Idaho

Jerry L. Young
Professor of Mathematics
Boise State University
Boise, Idaho

Evelyn Cairns
Elementary School Programs Coordinator
State Department of Education
Boise, Idaho

Tom C. Farley
Mathematics Coordinator
Curriculum Committee Chairman
State Department of Education
Boise, Idaho

INTRODUCTION AND STATEMENT OF PHILOSOPHY

Many of the concepts expressed in this guide are not new. However, the necessity of continually integrating these concepts, whether new or old, into the curriculum is very important. The necessity of integrating these concepts into a school's curriculum is supported by statements taken from curriculum guides adopted in Oregon, Washington, California, Vermont, Michigan and Alabama.

With this support in mind, the Idaho K-8 Curriculum Committee submits the following as an Introduction and Statement of Philosophy.

THE NEED FOR CHANGE

The Effects of Technology

Technological developments are entering our daily lives at an ever increasing degree. We casually watch the evening news as live pictures from countries thousands of miles away are beamed into our living rooms. We pick up the phone and talk to a friend in Japan as though we were calling across town. We stand in line at the supermarket chatting with the checker while each item in our shopping cart is automatically priced and listed on our receipt with one motion of the checker's hand. We give messages to answering machines, receive phone calls from computers, and get money from the bank without ever talking to another person.

When we step inside a school to see how technology is affecting the daily lives of children, we notice something interesting. While the world around them has changed dramatically, children are still tediously working on page after page of arithmetic problems, filling in the answers in the same way their grandparents did. But, while Robert is figuring out the answer to a long division problem, his grandfather is using a calculator to balance his checkbook, and the cash register is telling his brother the amount of change to give a customer. Robert's parents are studying a computer printout with the financial information they need in order to make a decision about which IRA to buy.

The contrast between Robert's school experiences and the world in which he lives is striking. **The impact of technology and its implications for mathematics education can no longer be ignored.** The modern world demands an ability to think about and to use mathematical ideas to solve problems and to make decisions. We cannot continue the rituals for producing only correct answers. Instead of requiring students to spend years studying arithmetic as a series of rules and rote procedures, it is time to provide the opportunity for all students to experience the richness and beauty of the study of mathematics as a whole. Students need to know how to apply those experiences and to appreciate the beauty in their everyday lives. The time our students spend learning
mathematics can no longer be limited to practicing long and tedious procedures which are more efficiently done with hand held calculators or computers. Now we can, and indeed we must, enrich and strengthen the mathematics education our children receive.

TEACHING FOR UNDERSTANDING AND APPLICATION

Expanding Our View of Mathematics

Students' experiences with mathematics can change only if we in the educational community expand our view of what mathematics is. Mathematics is not simply arithmetic procedures or algebraic formulas. It is not just pages to complete in a mathematics textbook, flashcards or timed tests, or even drill and practice computer games. It is not a subject that inherently or inevitably breeds feelings of anxiety and incompetence. Neither is it just for the intellectually elite.

Mathematics is actually very much a part of life. It is present all around us. We see it in the grace and utility of the Golden Gate Bridge. We see it in the design and pattern of great grandmother's quilt. We sense it in the movement and predictability of the seasons. It is in the everyday things we do. It is buying the right amount of wallpaper to decorate a bedroom, finding you're finally up to your mom's shoulder, and figuring out how much more money you need to save to get a new radio. It is necessary to teach mathematics so that it is not feared but is understood as being present in our lives.

Mathematics is concerned with making sense of the world. It is natural for children to seek order, beauty, and consistency. From the very beginning of a child's life, he or she is searching to organize and understand his or her world. Children notice size, shape, and position. They wonder how long, how big, and how much. Mathematical thinking is that which helps us to make connections, to see order and logic. It is seeing patterns and making predictions. It is estimating, proving, solving, and creating. We need to help children better organize, analyze, synthesize, and apply whatever mathematically confronts them.

The mathematics that our children study in school should be consistent with the nature of the subject. That means students should be learning mathematics in ways that allow them to discover relationships and to develop understanding. **The fundamental premise on which these statements are based is that every aspect of mathematics that students study should enhance their understanding of mathematical ideas and promote the growth of thinking.**

The Teacher's Experience

For many years, teachers have established two goals: (1) To get their students through the material in their textbooks; (2) to ensure that their students do well on standardized tests.

These two goals have produced disturbing results. Students have come to measure their success in terms of their ability to produce right answers quickly. They do not measure success in terms of their ability to apply what they have learned. Therefore, they do not look for meaning in the mathematics they are learning. They memorize rules and procedures. If they forget the rule or misapply the procedure, they anxiously ask (or

passively wait to be told) **what** to do. They are not interested in **why** and are not encouraged to discover **how they can use** what they have learned. Thinking is not encouraged because of an overemphasis on speed of response.

Practice, review, and direction, which textbooks help provide, are without question important, but mathematics will constantly produce new and unusual situations. Without internalizing what is learned and without the ability to see extensions of what is learned, students are less able to understand total concepts and apply their learning. Therefore, the textbook cannot be the total curriculum nor should it be considered the sole source for material or concepts to be learned.

Regardless of the particular classroom situations in which teachers work, they have similar stories to tell about children who have trouble with mathematics. They see the same, familiar errors over and over again and soon are able to predict what students will do when given certain types of problems. As every teacher can testify, just because something has been taught does not mean it has been learned or, more to the point, that it has been understood. Examples include adding positive and negative numbers, operations involving fractions, and multiplying decimal numbers, just to name a few.

There is evidence that the teaching for understanding and problem solving does raise standardized test scores. The use of manipulatives, experiential activities, and the study of mathematics as a "whole" has proven to be extremely beneficial. Recommendations by the National Council of Teachers of Mathematics and the program implemented by the Marion, Indiana School District indicate that going from a "rule-oriented" to a "process-oriented" curriculum and providing continued teacher inservice progressively improved student test scores. In the early years of a child's development the progress is slower; but as a child continued through this curriculum, progress is rapid.*

Why Haven't Practice and Review Worked

There are at least three major factors at work that contribute to the frustrations of teachers and students involved in the teaching and learning of mathematics. One contributing factor is that we teach as though symbols have obvious and inherent meaning. A second is that we too often teach without considering the students' level of cognitive maturity, not recognizing that what seems obvious to us as adults may not be obvious to the child. And a third is that, in our search for the ever clearer explanation, we often overlook the importance of the students' need to construct their own understanding.

*Wheatley, Grayson, Problem Solving Makes Math Scores Soar

Consider this useful analogy taken from the K-8 Curriculum Guide written by the California State Department of Education:

> Consider the problem of teaching as though symbols had meaning. If you were shown a picture of someone you had never met and were told the name associated with that picture, you could learn to say the appropriate name on cue whenever asked. However, you would not really know the person represented by the picture and would have difficulty if you were to describe that person's characteristics or be asked to predict that person's behavior. You would have no personal experience on which to base your answer. On the other hand, if the picture were of a beloved friend or family member, seeing the picture would be enough to remind you of many qualities the person had. So it is with the learning of mathematical symbols.

There is no meaning in symbols themselves, only in the mind of the person perceiving the symbols. **If a child does not have an understanding of the concept represented by a symbol, no amount of practice working with that symbol will help to develop that concept.** And, symbols are part of the language of mathematics, (numbers, letters, shapes, etc.).
Learning the symbolic representations of concepts is an important part of learning mathematics. However, students are often required to deal with symbols before they have full understanding of the complex ideas represented. Most mathematical ideas that children encounter in school can be understood only after they have had many experiences confronting the idea in a variety of settings. Students need time to develop a full understanding of mathematical ideas before they are asked to deal with these ideas as symbols isolated from the real world. When students do not understand a mathematical idea, they have no way of making sense of the symbols and can complete their assignments only by rote memorization of the required procedures.

The interaction between the child's level of cognitive maturity and the need to construct his or her own understanding has implications for the way in which students receive the instruction they are given. regardless of the age or the ability of the students, their experiences with mathematics teach children something about themselves and their place in the world. The **way** we teach children mathematics has a profound effect on whether or not they think mathematics is something they can do. The **way** encompasses all we can know in terms of what we know about the child, what we know about the subject matter, the strategies used in teaching, and an evaluation procedure to measure outcomes. Therefore, it is vitally important that any changes in the teaching of mathematics be carried out in light of what we know about how children learn, with the aim of higher expectations for children's growth in understanding.

Teaching Mathematics Can Be Different

In spite of children's active interest in making sense of the world, we have in the past encountered many problems in teaching mathematics to children. Many children view mathematics as simply too hard to understand. They are often frustrated and develop feelings of math anxiety or avoidance. These problems arise, not because of the nature of mathematics itself, but because we attempt to teach mathematics in ways that do not take into consideration what we know about how children learn. We do not give children the kind of support and mathematical tools they need to develop understanding.

Mathematics instruction can be different. We have to provide the kinds of experiences that will allow all students to make sense of mathematics. Providing such experiences not only provides for all ability levels but will also deepen and enhance our best students' understanding.
The State Department of Education Mathematics Curriculum Committee organized this course of study guide around 12 critical components. They are:

1. Problem solving and applications
2. Whole numbers and operations
3. Rational numbers and operations
4. Measurement
5. Relations and functions
6. Geometry
7. Probability and statistics
8. Integers
9. Irrational numbers
10. Technology
11. Career awareness
12. Algebraic principles

The committee drew upon various resources to identify these critical components. They include, the National Council of Teachers of Mathematics, available state curriculum guides, mathematics publications and the State Department of Education. For all grade levels, most of the critical components must be included in the instruction and all of the listed objectives should be goals for that grade level.

WITH THIS INTRODUCTION AND PHILOSOPHY IN MIND, IT IS INTENDED THAT THE K-8 MATHEMATICS COURSE OF STUDY GUIDE OUTLINED IN THIS DOCUMENT WILL SERVE AS A MODEL FOR LOCAL IDAHO SCHOOL DISTRICTS IN THEIR MATHEMATICS CURRICULUM DEVELOPMENT.

VOCABULARY

POSITION STATEMENT

The use of mathematics terminology and symbols is an integral part of the study and application of mathematics at all levels. The State Department of Education recommends that all teachers of mathematics use correct mathematical terms, including correct spelling, in the process of their teaching. This approach, when applied consistently at all grade levels, will provide students with a much greater ability to progress. This would eliminate the confusion of language and enable students to more comfortably read mathematics texts and participate in mathematical dialogue. It is recommended that textbook glossaries and appropriate mathematical dictionaries be utilized at each grade level.

See Appendix A

KINDERGARTEN

In order to help insure what should be learned at the kindergarten grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Geometry
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Experience problem solving by patterning, classifying, graphing and estimating.

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will have experiences with the whole numbers 0-10.

OBJECTIVES: Students will

1. Use manipulatives to count objects to 10 or more, find one to one correspondence, understand ordinals 1st, 2nd, etc., recognize numerals to 10 or more, and group sets from 2 to 10.

2. Have experience writing numerals 0-10.

B. **GOAL:**

Students will have experiences with comparisons of numbers.

OBJECTIVE: Students will

1. Use manipulatives to match and compare sets of objects.

III. RATIONAL NUMBERS AND OPERATIONS

A. **GOAL:**

Students will experience fractions through functional uses.

OBJECTIVES: Students will

1. Divide objects to show equal or unequal parts.
2. Use the terms: All, most, half, a little, part of, etc., when discussing their experiences.

IV. MEASUREMENT

A. **GOAL:**

Students will experiment with measurement.

OBJECTIVES: Students will

1. Use non-standard measurement materials to measure objectives in their environment.
2. Compare sizes of objects in their environment and use appropriate vocabulary to describe them.
3. Estimate the measurement of objects.
4. Develop an awareness of time through calendar experiences, the sequence of a day, and a year's activities.
5. Have experiences recognizing and using a penny, nickel and dime.

V. GEOMETRY

A. GOAL:

Students will have experiences recognizing and naming geometric shapes and objects in their environment.

OBJECTIVES: Students will

1. Identify the plane figures, circle, triangle, square and rectangle as they appear in the environment.

2. Differentiate between plane and solid figures.

3. Begin to use vocabulary of spatial relationships.

VI. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computer and calculators when applicable or when they facilitate the learning activity.

VII. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

FIRST GRADE

In order to help insure what should be learned at the first grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to solving problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Use problem solving strategies to include: Asking questions, choosing an operation, using a concrete model, acting out, looking for a pattern, organizing information, making drawings, guessing and checking, and using one or more operations.

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will be able to understand number concepts involving 0-100.

OBJECTIVES: Students will

1. Be able to compare sets and compare numbers; recognize more, less, and equal to; and use one to one correspondence.

2. Be able to count from 0-100, read and write numerals up to 100, read number words to 10 and identify ordinals through fifth.

3. Recognize and use two digit place value.

B. **GOAL:**

Students will be able to apply appropriate computational skills to specific applications.

OBJECTIVES: Students will

1. Be able to understand and use addition and subtraction facts through 18.

2. Be able to understand commutative and associative properties of addition.

3. Be able to apply appropriate operation whether written vertically or horizontally and compute inverse operation.

III. RATIONAL NUMBERS AND OPERATIONS

A. **GOAL:**

Students will be able to understand the concept of rational numbers. (fractions)

OBJECTIVES: Students will

1. Know the meaning of and compare halves (1/2's), thirds (1/3's) and fourths (1/4's).

2. Be able to identify and construct rough models of the above fractions.

IV. MEASUREMENT

A. **GOAL:**

Students will become familiar with both customary and metric systems of measurement.

OBJECTIVES: Students will

1. Estimate and measure inch, foot, centimeter.

2. Identify month, week, day, hour, and half hour (both standard and digital).

3. Identify a dozen.

4. Recognize, understand the value of, and use estimation involving pennies, nickels, dimes and quarters.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will understand number relations and their functions.

OBJECTIVES: Students will

1. Count by groups (step counting) 2's, 5's and 10's.
2. Recognize number patterns.
3. Develop mathematical sentences.

VI. GEOMETRY

A. GOAL:

Students will identify and use common geometric forms and shapes.

OBJECTIVES: Students will

1. Be able to sort, compare sizes, and construct examples of circles, squares, rectangles, triangles, and identify congruent figures.
2. Identify three dimensional figures: Cubes, cylinders, spheres, and pyramids.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Gather and organize information to make tables, bar graphs, and picture graphs.

VIII. TECHNOLOGY

A. **GOAL:**

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computer and calculators when applicable or when they facilitate the learning activity.

IX. CAREER AWARENESS

A. **GOAL:**

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

SECOND GRADE

In order to help insure what should be learned at the second grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Differentiate between tasks requiring rote skills and those requiring critical and creative thinking skills.

3. Solve problems by choosing correct operations, asking questions, looking for patterns, making a drawing, working in groups, etc.

4. Solve problems related to familiar real life situations.

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will understand numbers to 1000.

OBJECTIVE: Students will

1. Read, write, say, and order numbers to 1000, implementing the place value concept to include the hundreds' place.

B. **GOAL:**
Students will understand 2 and 3 digit numbers.

OBJECTIVE: Students will

1. Add and subtract 2 digit numbers with regrouping and 3 digit numbers without regrouping.

C. **GOAL:**
Students will understand sets.

OBJECTIVE: Students will

1. Compare sets to determine <, =, >, to include the empty set.

D. **GOAL:**
Students will apply computational skills to specific applications.

OBJECTIVE: Students will

1. Know addition facts through 18 and will explore repeated addition (in preparation for multiplication).

III. RATIONAL NUMBERS AND OPERATIONS

A. **GOAL:**
Students will recognize rational numbers.

OBJECTIVE: Students will

1. Continue to explore the rational numbers: 1/4, 1/3, 1/2, 2/3, 2/4, 3/4, 2/2, 3/3, 4/4.

IV. MEASUREMENT

A. **GOAL:**
Students will become familiar with both customary and metric measuring systems.

OBJECTIVE: Students will

1. Measure length to the nearest centimeter and inch, identify all coins and their values, and know the difference between day, week and month.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will become familiar with simple equations and number patterns.

OBJECTIVES: Students will

1. Solve and write mathematical sentences using one digit numbers.

2. Work with number patterns to include even numbers, odd numbers, multiples of five and ten.

VI. GEOMETRY

A. GOAL:

Students will become familiar with topics in geometry.

OBJECTIVE: Students will

1. Identify geometric shapes and their parts to include the circle, square, triangle, rectangle and will make comparisons between shapes. (congruence)

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will become familiar with topics in probability and statistics.

OBJECTIVE: Students will

1. Compile data and demonstrate their results on charts or graphs.

VIII. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computers and calculators when applicable or when they facilitate the learning activity.

IX. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

THIRD GRADE

In order to help insure what should be learned at the third grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVE: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

II. WHOLE NUMBER AND OPERATIONS

A. GOAL:

Students will understand numbers to 10,000.

OBJECTIVES: Students will

1. Read, write and order numbers to 10,000, implementing place value concepts to include 1,000's place value.

2. Demonstrate the multiplication process of factors by the use of manipulatives and then by the use of symbolism.

3. Apply and practice skills of + and -, using whole numbers including regrouping.

4. Round numbers to the nearest 10's and 100's.

III. RATIONAL NUMBERS AND OPERATIONS

A. GOAL:

Students will **increase** their understanding of rational numbers.

OBJECTIVES: Students will

1. Use mixed fractions to identify quantities.
2. Begin to compare fractional sizes.

IV. MEASUREMENT

A. GOAL:

Students will apply measurement to life situations.

OBJECTIVES: Students will

1. Apply linear units of measurement to find perimeter of a plane figure.
2. Determine the total value of a set of coins.
3. Tell time to the minute.
4. Read Celsius and Fahrenheit thermometer.
5. Compare capacities/volumes.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will write, apply and solve simple equations.

OBJECTIVE: Students will

1. Write a mathematical sentence involving addition and subtraction of whole numbers, including missing addends.

VI. GEOMETRY

A. GOAL:

Students will increase their understanding of geometric concepts.

OBJECTIVES: Students will

1. Identify the properties and characteristics of solid and plane figures.
2. Experience the concept of congruence by manipulation of plane figures.
3. Identify angles: Right, acute and obtuse.
4. Identify the line of symmetry on a given figure.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will begin to understand chance.

OBJECTIVES: Students will

1. Experiment with chance in the use of spinners, etc.
2. Read graphs to gain information.
3. Develop simple graphs to show relationships.

VIII. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computers and calculators when applicable or when they facilitate the learning activity.

IX. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

FOURTH GRADE

In order to help insure what should be learned at the fourth grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Use appropriate problem solving strategies to include:

   a. Asking questions
   b. Choosing an operation
   c. Using a concrete model/acting out
   d. Looking for a pattern
   e. Logical reasoning
   f. Using probability and predicting
   g. Estimating
   h. Stitching, drawing and diagramming (including tables/charts)
   i. Guessing and checking
   j. Using a formula, equations, and proportions
   k. Working backward
   l. Student groups and individual problem solving

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will recognize numbers to 1,000,000.

OBJECTIVE: Students will

1. Name, write, compare and order numbers through 1,000,000.

B. GOAL:

Students will work with 4 and 5 digit numbers and understand the value of their digit places.

OBJECTIVE: Students will

1. Add and subtract 4 and 5 digit numbers with regrouping, and develop rounding and estimating skills.

C. GOAL:

Students will be able to multiply and divide numbers up to two digits.

OBJECTIVES: Students will

1. Know multiplication facts through 9 x 9.
2. Multiply two digit numbers by one and two digit numbers.
3. Understand how to use one digit divisors, and develop rounding and estimating skills.
4. Learn that subtraction and addition are opposite operations and that division and multiplication are opposite operations.

III. RATIONAL NUMBERS AND OPERATIONS

A. GOAL:

Students will continue to increase their understanding of rational numbers.

OBJECTIVES: Students will

1. Compare fractions with regard to <, =, or >.

2. Recognize fractions with various denominators, if they are improper or mixed, and name them appropriately.

3. Analyze fractional parts by working with appropriate shaded regions of a whole.

B. **GOAL:**

Students will understand and solve decimal problems.

OBJECTIVE: Students will

1. Compute problems involving money amounts in decimal notation.

IV. MEASUREMENT

A. **GOAL:**

Students will become familiar with both customary and metric systems of measure.

OBJECTIVES: Students will

1. Estimate and measure using millimeters, centimeters, meters, kilometers and appropriate customary units of measure to include length and perimeter.

2. Estimate and measure area and mass using metric units and customary units.

3. Measure time and temperature.

V. RELATIONS AND FUNCTIONS

A. **GOAL:**

Students will develop knowledge of equations and number patterns.

OBJECTIVES: Students will

1. Write and solve number sentences using one and two digit numbers using all four arithmetic operations.

2. Recognize number sequences involving multiples of one digit numbers and discover rules that determine patterns.

VI. GEOMETRY

A. GOAL:

Students will recognize lines, angles, polygons, parallel lines and solids.

OBJECTIVES: Students will

1. Distinguish between linear and non-linear lines, recognize parallel lines intuitively, name polygons and recognize spheres and angles.

2. Determine congruence and symmetry intuitively.

3. Distinguish perimeter from area.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will use graphs, charts and tables to evaluate problems involving the compilation of data.

OBJECTIVES: Students will

1. Observe maximum and minimum values from charts, graphs and tables.

2. Construct simple charts, graphs and tables.

3. Determine probabilities from experiments with spinners, coins, dice, etc.

VIII. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVES: Students will

1. Use computers and calculators when applicable or when they facilitate the learning activity.

IX. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

FIFTH GRADE

In order to help insure what should be learned at the fifth grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Use appropriate problem solving strategies to include:

   a. Asking questions
   b. Choosing an operation
   c. Using a concrete model/acting out
   d. Looking for a pattern
   e. Logical reasoning
   f. Using probability and predicting
   g. Estimating
   h. Stitching, drawing and diagramming (including tables/charts)
   i. Guessing and checking
   j. Using a formula, equations, and proportions
   k. Working backward
   l. Student groups and individual problem solving

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will recognize numbers 0-1,000,000,000.

OBJECTIVE: Students will

1. Identify, read, write, compare and order numbers 0-1,000,000,000.

B. GOAL:

Students will understand 6 digit numbers and the value of their digit places.

OBJECTIVE: Students will

1. Add and subtract 6 digit numbers with regrouping and develop rounding and estimating skills.

C. GOAL:

Students will understand multiplication and division using up to 3 digit numbers.

OBJECTIVES: Students will

1. Multiply 3 digit numbers by 2 digit numbers.

2. Understand how to use 2 digit divisors and develop rounding and estimating skills in division.

3. Demonstrate the ability to use factors and prime factorization.

D. GOAL:

Students will learn the properties of natural numbers.

OBJECTIVES: Students will

1. Be able to identify and apply the commutative and associative properties of addition and multiplication.

2. Solve equations using the distributive property, identity property and the multiplication property of 0.

III. RATIONAL NUMBERS AND OPERATIONS

A. GOAL:

Students will continue to develop skills in the use of rational numbers.

OBJECTIVES: Students will

1. Write fractions for parts of regions or sets; find equivalent and lowest-term fractions.
2. Compare and order fractions.
3. Add and subtract fractions and mixed numbers with like denominators.
4. Find products of fractions and mixed numbers.
5. Learn to change percent to decimals to fractions.
6. Identify a fraction's reciprocal and recognize that their product equals 1.

B. GOAL:

Students will continue working with decimal problems.

OBJECTIVES: Students will

1. Read and write decimals through 1,000ths.
2. Compare and order decimals.
3. Round decimals to the nearest whole number and to the nearest 10th.
4. Add and subtract decimals through 1,000ths.
5. Find products when one or both factors are decimals.
6. Find quotients of decimals divided by a 1 digit whole number.
7. Multiply and divide decimals by multiples of 10.

IV. MEASUREMENT

A. GOAL:

Students will learn to use both standard and metric systems of measurement.

OBJECTIVES: Students will

1. Estimate and measure length using millimeters, centimeters, meters, kilometers, inch, foot, yard, and mile.
2. Find the perimeter and the area of a given plane figure.
3. Find the volume or the capacity of a given container using metric or standard units.
4. Estimate and measure weights using grams, kilograms, ounces and pounds.
5. Estimate and measure temperature using degrees (Celsius and Fahrenheit).
6. Estimate and measure right, obtuse, and acute angles.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will continue to work with simple equations and number patterns.

OBJECTIVES: Students will

1. Solve equations using all 4 operations while using no more than 2 digit numbers with whole number solutions.
2. Recognize number patterns with an emphasis on the discovery of the patterns origin.

VI. GEOMETRY

A. GOAL:

Students will identify, measure and classify common geometric figures.

OBJECTIVES: Students will

1. Identify points, lines, segments, and parallel, perpendicular and intersecting lines.
2. Identify and classify polygons according to the measure of their angles, length of their sides, and number of sides.
3. Identify and measure the radius and diameter of a circle.
4. Identify and compare congruent and similar plane figures.
5. Identify solid figures and count their vertices, faces, and edges.
6. Identify plane figures having line and point (rotational) symmetry.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will understand, collect and organize data for analysis.

OBJECTIVES: Students will

1. Read, interpret and make graphs for data analysis.
2. Find the probability of a simple event.
3. Compute the mean, median, mode, and range of a set of numbers.

VIII. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computers and calculators when applicable or when they facilitate the learning activity.

IX. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

SIXTH GRADE

In order to help insure what should be learned at the sixth grade level, instructors must deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Integers
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.

2. Use appropriate problem solving strategies to include:

   a. Asking questions
   b. Choosing an operation
   c. Using a concrete model/acting out
   d. Looking for a pattern
   e. Logical reasoning
   f. Using probability and predicting
   g. Estimating
   h. Sketching, drawing and diagramming (including tables/charts)
   i. Guessing and checking
   j. Using a formula, equations, and proportions
   k. Working backward
   l. Student groups and individual problem solving

II. WHOLE NUMBER AND OPERATIONS

A. GOAL:

Students will be able to apply appropriate computational skills to specific applications.

OBJECTIVES: Students will

1. Maintain skills and understand addition, subtraction multiplication, and division of whole numbers.

2. Demonstrate ability in multiplication for whole numbers using:

    a. Commutative property
    b. Associative property
    c. Distributive property
    d. Estimating
    e. Multiples
    f. Factors and prime factorization

3. Demonstrate ability in division of whole numbers using:

    a. Division of five-digits by three-digits
    b. Zero in the quotient

        1. Division by "O" is not clearly defined

    c. Estimating
    d. Inverse operations

4. Manipulate whole numbers by understanding the base, exponent or power (exponential notation).

B. GOAL:

Students will recognize place-value of whole numbers.

OBJECTIVES: Students will

1. Identity place-value to hundred billions

2. Write number words

3. Round to a given place-value

III. RATIONAL NUMBERS AND OPERATIONS

A. GOAL:

Students will be able to apply appropriate computational skills to specific applications or rational numbers (fractions).

OBJECTIVES: Students will

1. Find equivalent fractions, compare and simplify fractions, and express common fractions as a mixed number.

2. Add and subtract common fractions with like and unlike denominators, and find the sum and difference of mixed numbers with regrouping.

3. Multiply common fractions and mixed numbers, find the reciprocal of a fraction or whole number, and divide common fractions and mixed numbers.

B. GOAL:

Students will understand and apply the value of the decimal in the number system.

OBJECTIVES: Students will

1. Read, write, and identify place value to the ten thousandths.

2. Compare and order decimals.

3. Round decimals to a given place value.

4. Express given decimals as percents or fractions.

C. GOAL:

Students will be able to apply appropriate computational skills to specified applications of decimals.

OBJECTIVES: Students will

1. Maintain addition and subtraction skills using decimals.

2. Estimate the product and multiply a decimal by a whole number, power of 10, or another decimal.

3. Estimate the quotient and divide a decimal by a whole number, power of 10, or another decimal.

4. Write the ratio of two quantities and complete an equal ratio.

IV. MEASUREMENT

A. GOAL:

Students will become familiar with both customary and metric units of measurement.

OBJECTIVES: Students will

1. Understand and apply units of measure in customary and metric units by estimating:

   a. Length
   b. Area and Perimeter
   c. Weight
   d. Capacity/volume
   e. Temperature

2. Understand and apply units of measure by solving problems using computational skills.

B. GOAL:

Students will be able to understand and apply basic units of time.

OBJECTIVES: Students will

1. Change from one unit of time to another.

2. Add or subtract units of time.

3. Become familiar with different time zones.

4. Apply these skills in problem solving.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will understand number relations and their functions.

OBJECTIVES: Students will

1. Compute vertical and horizontal equations and apply grouping symbols and order of operations.

VI. GEOMETRY

A. GOAL:

Students will understand number relations and their functions.

OBJECTIVES: Students will

1. Identify and measure the families of quadrilaterals, triangles, angles, and polygons.
2. Identify three dimensional figures and find volume and surface area of rectangular prisms.
3. Determine the perimeter and area of plane figures including circumference of a circle.
4. Use formulas and pi (~).
5. Determine whether two figures are congruent and identify corresponding parts.
6. Identify parallel and perpendicular lines.
7. Identify lines of symmetry of a given figure.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will be exposed to the use of ratio, proportions, and statistics.

OBJECTIVES: Students will

1. Write the ratio of two quantities and complete an equal ratio.

2. Read, interpret, and make graphs of data.

3. Compute mean, median, mode, and range in problem solving situations.

4. Predict outcomes, relative frequencies, and probabilities.

VIII. INTEGERS

A. GOAL:

Students will be introduced to integers

OBJECTIVES: Students will

1. Understand the concept of opposites or numbers that are negatives of each other.

2. Use the number line as a model.

3. Identify "0" as a reference point between positive and negative integers.

4. Understand that simple differences, (5 - 8), yields a negative integer.

IX. TECHNOLOGY

A. GOAL:

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computers and calculators when applicable.

X. CAREER AWARENESS

A. GOAL:

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

SEVENTH-EIGHTH GRADE

The seventh/eighth grade mathematics curriculum is usually the "last stop" before a student's first course in algebra. To make this transition, it is imperative that the following topics, having been previously presented as somewhat separate entities, be tied together as comprehensively as possible.

Proper Fractions	Ordering Fractions
Improper Fractions	Ratio
Mixed Numbers	Proportion
Decimal Numbers	Percent
Reciprocals	Equivalent Fractions

It is essential that intermediate grade level teachers begin to use terminology consistent with the language of algebra. Students, at this level, need to understand, operate with, and apply all forms of rational numbers. For example, the word "fraction" should be replaced by "rational number." Additionally, a term such as "improper fraction" could be explained and then avoided, since there is nothing "wrong" with a number that has a numerator larger than its denominator. Also, the idea of a mixed number, while useful in grades K-6, is often better replaced by its rational number equivalent for ease in operations and consistency with applications found in algebra. The experienced teacher, with a solid background in algebra, will no doubt discover many such ideas that will help prepare students for the transition to the algebra course.

In order to help insure what should be learned at the seventh and eighth grade levels, instructors might deal significantly with:

- Problem Solving and Applications
- Whole Numbers and Operations
- Rational Numbers and Operations
- Measurement
- Relations and Functions
- Geometry
- Probability and Statistics
- Integers
- Technology
- Career Awareness

I. PROBLEM SOLVING AND APPLICATIONS

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Learn to identify problems, develop strategies to solve them, and explore applications to real life situations.
2. Translate problems into algebraic equations.
3. Use all problem solving strategies where appropriate.

II. WHOLE NUMBERS AND OPERATIONS

A. GOAL:

Students will be able to apply appropriate computational skills to specific applications.

OBJECTIVES: Students will

1. Read and write whole numbers and use place value ideas to compare, order, and round whole numbers.
2. Recognize basic properties of addition and multiplication and perform operations in the correct order.
3. Estimate sums, differences, products, and quotients of whole numbers.
4. Find the prime factorization of a composite number and find the greatest common factor and least common multiple of two numbers.

B. GOAL:

Students will continue to explore the use of exponential notation.

OBJECTIVE: Students will

1. Write repeated factors using exponential notation and use scientific notation to express large numbers.

C. **GOAL:**

Students will solve equations.

OBJECTIVES: Students will

1. Evaluate expressions using addition, subtraction, multiplication, and division.

2. Write and solve addition, subtraction, multiplication and division equations.

3. Solve equations with more than one operation.

III. RATIONAL NUMBERS AND OPERATIONS

A. **GOAL:**

Students will master arithmetic operations with rational numbers.

OBJECTIVES: Students will

1. Add, subtract, multiply and divide rational numbers to include improper and proper fractions, mixed numbers and complex fractions.

2. Perform operations with rational numbers with various grouping symbols, to include the "fraction bar" as a grouping symbol.

3. Add, subtract, multiply and divide decimal numbers and perform these operations with various grouping symbols.

4. Intermix operations with decimal numbers and fractions, including converting from one notation to the other.

5. Learn concepts dealing with repeating decimals.

B. **GOAL:**

Students will learn the concepts dealing with ratio, proportion, and percents.

OBJECTIVES: Students will

1. Learn to compare two quantities by developing ratios, and write those ratios as percents, and then write those percents as ratios.

2. Solve problems by using proportion.

3. Solve problems using percents.

4. Use integers as numerators or denominators when writing rational numbers.

IV. MEASUREMENT

A. GOAL:

Students will become familiar with concepts of measurement using both customary and metric units.

OBJECTIVE: Students will

1. Be able to understand, select, and apply units of measurement in computing and estimating length, area, perimeter, volume, mass, and temperature.

V. RELATIONS AND FUNCTIONS

A. GOAL:

Students will understand number relations and their functions.

OBJECTIVES: Students will

1. Be able to complete sequential numbers in a given pattern.

2. Identify and graph ordered pairs in a coordinate plane.

3. Demonstrate understanding of "Order of Operations."

4. Understand and write variables and expressions.

5. Solve equations with distributive, associative and commutative properties and use inverse operations.

6. Demonstrate an understanding of one to one correspondence.

VI. GEOMETRY

A. GOAL:

Students will be able to identify and use common geometric concepts.

OBJECTIVES: Students will

1. Be able to identify and use points, rays, lines, line segments, angles, parallel lines, perpendicular lines, and intersecting lines.

2. Be able to identify and use plane and three dimensional figures.

   a. Plane: Polygons, circles, triangles, quadrilaterals
   b. Solid: Spheres, prisms, pyramids, cones, cylinders (three dimensional)

3. Be able to identify and apply the concepts of symmetry, congruency, and corresponding sides.

4. be able to identify and apply geometric formulas.

VII. PROBABILITY AND STATISTICS

A. GOAL:

Students will use data gathering devices to collect, organize and understand data for analysis.

OBJECTIVES: Students will

1. Compute the mean, median, mode and range in problem solving situations.

2. Read, interpret, and develop a variety of graphs.

3. Read, calculate, and interpret probabilities as chance.

4. Students will use ratios, fractions, decimals, and percents to express probabilities of simple events.

VIII. INTEGERS

A. **GOAL:**

Students will learn about integers and integer operations.

OBJECTIVES: Students will

1. Compare and order integers.
2. Add, subtract, multiply and divide integers.
3. Solve problems and equations involving integers.
4. Graph equations and ordered pairs.

IX. IRRATIONAL NUMBERS

A. **GOAL:**

Students will learn about irrational numbers.

OBJECTIVE: Students will

1. Distinguish between rational and irrational numbers.

X. TECHNOLOGY

A. **GOAL:**

Students will have supplemental experiences with technology when available and appropriate.

OBJECTIVE: Students will

1. Use computers and calculators when applicable.

XI. CAREER AWARENESS

A. **GOAL:**

Students will develop an awareness of different careers which use mathematics.

OBJECTIVE: Students will

1. Become familiar with various careers in mathematics by role playing, problem solving, identifying and classifying.

XII. ALGEBRAIC PRINCIPLES

A. GOAL:

Students will prepare for their first course in algebra.

OBJECTIVE: Students will

1. Complete the necessary pre-requisites for either Pre-algebra or Algebra I by learning material based upon the identified critical components in the K-8 Mathematics Course of Study Guide.

PRE-ALGEBRA

Course Description

Pre-algebra, as its name implies, is a math course emphasizing the basic core goals of General Mathematics but with an emphasis on skills leading to preparation for Algebra I.

Critical Components

In order to help insure what should be learned at the pre-algebra level, instructors must deal significantly with:

- Problem Solving, Logic, Estimation (Applications)
- Number Systems and Operations in those Number Systems
- Variables (whole, natural, rational and irrational numbers and integers)
- Functions and Relations
- Graphs
- Probability and Statistics
- Geometry, Measurement

I. PROBLEM SOLVING, LOGIC, ESTIMATION (APPLICATIONS)

A. GOAL:

Students will be aware of problem solving strategies and be able to apply such strategies to problems.

OBJECTIVES: Students will

1. Clarify the problem by asking questions.
2. Make and use a drawing or a model.
3. Make a systematic list or table.
4. Break a problem into manageable parts.
5. Look for patterns.
6. Guess and check.
7. Work backwards.
8. Eliminate possibilities.

B. **GOAL:**

Students will demonstrate proficiency in problem solving with the calculator and computer with appropriate answer estimation.

OBJECTIVES: Students will

1. Use the calculator in solving tedious and difficult problems.
2. Use the computer to extend the curriculum to some more realistic and meaningful problems.
3. Estimate and check answers.

C. **GOAL:**

Students will demonstrate their understanding of logic.

OBJECTIVES: Students will

1. Use flow charting and sequential step listing for planning and problem solving.
2. Prove or "show" simple conclusions with deductive reasoning.

II. NUMBER SYSTEM AND OPERATIONS

A. **GOAL:**

Students will work with whole numbers, integers, rational and irrational numbers.

OBJECTIVES: Students will

1. Determine sums, differences, products and quotients of whole numbers, fractions, and decimal fractions.
2. Compute with percent, ratios and proportions, and their applications.
3. Graph rational numbers and integers using the number line and other modeling instruments.
4. Define and identify irrational numbers.
5. Compute with irrational numbers.

B. **GOAL:**

Students will be aware of and use technology where appropriate in computations with integers and rational numbers.

OBJECTIVE: Students will

1. Use a calculator and computer where applicable as a tool to compute with rational numbers and integers.

III. VARIABLES, FUNCTIONS AND RELATIONS

A. **GOAL:**

Students will usé the model of sets to interpret functions.

OBJECTIVES: Students will

1. Define a set and express a set in roster, rule, and graph form.
2. Identify a subset of a set.
3. Determine the union and intersection of two sets.
4. Graph a set of ordered pairs in a plane.
5. Determine the function rule for a set of ordered pairs that represent a function.
6. Substitute values for the variable in first and second degree functions and determine the truth set.

B. **GOAL:**

Students will solve equations.

OBJECTIVES: Students will

1. Translate between grammatical and mathematical phrases and sentences.
2. Determine the solution to equations involving addition and/or subtraction of polynomials.
3. Determine the solution to linear equations involving multiplication of a polynomial.

4. Evaluate an open expression given replacement values.

C. **GOAL:**
Students will simplify polynomials.

OBJECTIVES: Students will

1. Combine similar algebraic terms.
2. Determine the sum and difference of two polynomials.
3. Determine the product and quotient of two polynomials, a monomial and a binomial, and two binomials.
4. Simplify an expression containing at least three grouping symbols.
5. Apply these algebraic concepts to realistic and specific problems.

IV. GRAPHS

A. **GOAL:**
Students will use information from graphs, charts, tables and circle graphs.

OBJECTIVES: Students will

1. Read, interpret and draw conclusions from information in table and graph form.
2. Develop a hypothesis, collect appropriate new data, and construct a graph to display the data.

B. **GOAL:**
Students will relate number systems to graphs.

OBJECTIVES: Students will

1. Graph rational numbers on a number line.
2. Graph sets of ordered number pairs in a plane.
3. Graph simple relations and functions.

V. PROBABILITY AND STATISTICS

A. GOAL:

Students will understand collect and organize data for predicting.

OBJECTIVES: Students will

1. Collect data and find range, mean, mode and median.
2. Collect data and develop tables, charts, graphs and histograms.
3. Use the calculator or computer as a tool in analyzing data and determining probabilities.

VI. GEOMETRY AND MEASUREMENT

A. GOAL:

Students will apply measurement to common geometric objects.

OBJECTIVES: Students will

1. Determine the area of common geometric shapes and objects.
2. Determine the perimeter of common geometric shapes.
3. Determine the volume of common geometric solids.
4. Know and use the Pythagorean relationship.

ALGEBRA I

Course Description

This is generally the first course in the college preparatory mathematics program. Algebra is essentially generalized arithmetic and is a direct extension at this level of the mathematics program from the grade school. The concepts and content of Algebra I include the use of variables representing known or unknown quantities. These variables are then used in equations and inequalities to solve particular problems that would be more difficult without their use.

Algebra I, at the seventh or eighth grade level, will satisfy prerequisite requirements for the traditional Geometry/Algebra II sequence at the high school level, but completing the course, at this level, will not satisfy the state mathematics requirement for high school graduation.

Critical Components

In order to help insure what should be learned at the Algebra I level, instructors must deal significantly with:

- Problem Solving and Mathematical Reasoning
- Properties of Number Systems
- Solving Equations
- Solving Inequalities
- Polynomials and Factoring
- Functions, Relations, Variables
- Graphs
- Systems of Equations
- Radicals and Exponents, Irrational Numbers
- Quadratic Equations

I. PROBLEM SOLVING AND MATHEMATICAL REASONING

A. GOAL:

Students will understand and show proficiency in problem solving.

OBJECTIVES: Students will

1. Read and properly interpret problem statements.

2. Select appropriate problem solving strategies.

3. Apply strategies to solve "real world" problems.

4. Use calculators and/or computers as problem solving tools.

5. Use estimation skills to check reasonableness of solutions.

B. GOAL:

Students will understand inductive and deductive reasoning.

OBJECTIVE: Students will

1. Use

   a. Inductive and deductive reasoning to justify simple results.
   b. Valid argument forms, including direct and indirect reasoning.
   c. Deduction to derive proofs of theorems from axioms or previously proven theorems.

II. PROPERTIES OF REAL NUMBER SYSTEMS

A. GOAL:

Students will understand the structure and properties of the real number system.

OBJECTIVES: Students will

1. Use symbols of groupings, variables, exponents.

2. List and define the properties of the number system (i.e., commutative, associative, distributive, etc.)

3. Use the four operations in relation to the real number system.

4. Recognize and use basic theorems based on the properties of the real number system.

III. SOLVING EQUATIONS

A. GOAL:

Students will understand the use of variables, equations and the solution strategies for equations.

OBJECTIVES: Students will

1. Use the addition and subtraction principles in solving equations.
2. Use the multiplication and division principals in solving equations.
3. Transform word problems to equations, solve and check the solutions.

IV. SOLVING INEQUALITIES

A. GOAL:

Students will learn the skills necessary for solving inequalities.

OBJECTIVES: Students will

1. Develop an understanding of conjunction and disjunction and their relation to intersection and union of sets.
2. Solve problems involving inequalities.

V. POLYNOMIALS AND FACTORING

A. GOAL:

Students will understand what monomials, binomials, polynomials are and their uses.

OBJECTIVES: Students will

1. Define monomial, binomial, and polynomial.
2. Combine and simplify polynomial expression.
3. Factor monomials, binomials and polynomials.
4. Solve problems and equations involving polynomials.

VI. FUNCTIONS, RELATIONS, VARIATION

A. GOAL:

Students will understand relationships between systems and variables and how these relations may be expressed.

OBJECTIVES: Students will

1. Graph relations in the coordinate plane.
2. Express a relation or function as a line and determine the relation or function given a line.
3. Use direct and inverse variation.

VII. GRAPHS

A. GOAL:

Students will understand and interpret graphs.

OBJECTIVES: Students will

1. Graph linear equations in the coordinate plane.
2. Determine the slope of lines.
3. Develop equations of lines given the graph of lines.

VIII. SYSTEMS OF EQUATIONS

A. GOAL:

Students will understand systems of equations.

OBJECTIVES: Students will

1. Solve systems of linear equations using substitution and addition methods for solution.
2. Make application of systems of equations to meaningful problems.

IX. RADICALS, EXPONENTS, AND IRRATIONAL NUMBERS

A. GOAL:

Students will understand radicals, exponents and irrational numbers and their operations.

OBJECTIVES: Students will

1. Be able to define irrational numbers.
2. Do operations with radicals and exponents.
3. Use radicals with the Pythagorean property.

X. QUADRATIC EQUATIONS

A. GOAL:

Students will understand some applications and deviations of quadratic equations and solve them.

OBJECTIVES: Students will

1. Solve quadratic equations by simple factoring and completing the square.
2. Solve quadratic equations using the quadratic formula.

SCOPE AND SEQUENCE

The chart below indicates the level where critical components are taught. This is distinct from the "introduction" of topics which may occur at any time.

	K	1	2	3	4	5	6	7	8
Problem Solving and Applications	X	X	X	X	X	X	X	X	X
Whole Numbers and Operations	X	X	X	X	X	X	X	X	X
Counting	X	X	X	X	X	X	X	X	X
Place Value		X	X	X	X	X	X	X	X
Adding and Subtracting	X	X	X	X	X	X	X	X	X
Multiplying				X	X	X	X	X	X
Dividing					X	X	X	X	X
Properties of Operations		X	X	X	X	X	X	X	X
Factorization						X	X	X	X
Exponential Notation							X	X	X
Rational Numbers and Operations	X	X	X	X	X	X	X	X	X
Fractions	X	X	X	X	X	X	X	X	X
Operations with Fractions						X	X	X	X
Decimal Notation					X	X	X	X	X
Decimal Operations						X	X	X	X
Ratio/Proportion							X	X	X
Percent						X	X	X	X
The Rational Number System								X	X
Measurement	X	X	X	X	X	X	X	X	X
Relations and Functions	X	X	X	X	X	X	X	X	X
Relations	X	X	X	X	X	X	X	X	X
Equations		X	X	X	X	X	X	X	X
Number Patterns		X	X	X	X	X	X	X	X
Graphing (Coordinate Planes)								X	X
Geometry	X	X	X	X	X	X	X	X	X
Probability and Statistics		X	X	X	X	X	X	X	X
Integers							X	X	X
Irrational Numbers								X	X
Technology	X	X	X	X	X	X	X	X	X
Career Awareness	X	X	X	X	X	X	X	X	X
Algebraic Principals								X	X

APPENDIX A - Partial Vocabulary List

Absolute Value
Acute
Add
Addend
Algorithm
Angle
Arbitrary
Area
Associative
Average
Axiom
Base
Bisector
Centimeter
Chord
Circumference
Closure
Collection
Comparison
Components
Composite
Computational
Commutative
Concept
Concrete
Congruent
Corollary
Corresponding
Cuisenaire
Cumulative
Data
Decimal
Denominator
Diameter
Difference
Digit
Distributive
Dividend
Divisor
Equal
Equation
Equivalent
Estimate
Evaluate
Exponent Factor
Function
Gram
Hexagon
Hypotenuse
Hypothesis
Identity
Improper Fraction
Integer
Intersect
Inverse
Irrational Number
Kilogram
Kilometer
Less Than
Limit
Linear
Manipulative
Mass
Matching
Mathematics
Maximum
Mean
Measure
Median
Meter
Minimum
Minuend
Mode
Model
More Than
Multiple
Multiplicand
Numerator
Observation
Obtuse
Octagon
Operations
Ordinal
Parallel
Parallelogram
Pentagon
Percent
Perimeter
Perpendicular
Place Value
Plane
Point
Polygon
Postulate
Power
Prime
Prime Factorization
Probability
Problem
Product
Quadrilateral
Quantity
Quotient
Radius
Range
Ratio
Rational Number
Ray
Reciprocal
Rectangle
Recursive
Relation
Relative
Remainder
Rhombus

APPENDIX A - Continued

Scale
Segment
Sequence
Sequential
Series
Set
Sex Equity
Square
Square Root
Substitute
Subtrahend
Sum
Symmetry
Tracing
Value
Variable
Visualization
Volume
Whole Number

APPENDIX B - Partial Resource List

List of Potential Manipulative Counters and Materials:

Tangrams	Beans, Corn, Seeds
Pentominoes	Beads, Buttons, Bottle Caps
Pattern Blocks	Toothpicks
Unifix Cubes	Rubber Bands
Cuisenaire Rods	Butter, Cheese Tubs, etc.
Geoboards	String
Puzzles	Many Common Household Items

List of possible resources of instructional aids:

State Department of Education
State Textbook Adoption Manual
Mortensen Mathematics
Idaho Council of Teachers of Mathematics

Bibliography of Selected Instructional Resources:

Mathematics Their Way, Mary Baratta-Larton, Addison Wesley

Shape and Size, Nuffield Mathematics Project, John Wiley & Sons

Developing Skills In Estimation, Books A and B, Dale Seymour, Dale Seymour Publications

NCTM Yearbooks

Mathematics, A Human Endeavor, Harold R. Jacobs, W. H. Freeman and Company

Teaching Problem-Solving Strategies, Dolan and Williamson, Addison-Wesley

Activities from the Mathematics Teacher, National Council of Teachers of Mathematics (NCTM)

IDEAS from the Arithmetic Teacher, Grades 6-8, National Council of Teachers of Mathematics NCTM)

Multicultural Posters and Poster Activities, (1982 Single Topic Edition of Washington Mathematics), National Council of Teachers of Mathematics (NCTM)

APPENDIX B -- Continued

Developing Thoughtful Behavior in Mathematics, (1983 Single Topic Edition of Washington Mathematics), John Firkins, Washington State Mathematics Council

When Are We Ever Gonna Have To Use This?, Hal Saunders, Dale Seymour Publications

Aftermath, Seymour and Others, Creative Publications

TOPS, Greenes and Others, Dale Seymour Publications

The Answer Is One, Robert E. Barns

Games, Magazine, Playboy Publishing Company

How to Develop Problem-Solving With A Calculator, Janet Morris, National Council of Teachers of Mathematics (NCTM)

Problem-Mathics, Greenes and Others, Creative Publications

Wollywoggles and Other Creature, Thomas O'Brien

Developing Skills In Estimation, Books A and B, Dale Seymour, Dale Seymour Publications

Problem Solving In Mathematics, Lane E.S.D. Project, Dale Seymour Publications